101-04701/

97000133

Agro Forestry Project that Combines Trees and Shrubs with Annual and Perennial Crops

Lakefront Plantations

December, 2000 Final Report

Summary:

The three test crops (Ginkgo, Raspberries and Echinacea) associated with this project were all established in 1998. The Raspberries are strong, healthy plants that thrived through out the 1999 and 2000 growing seasons. The Ginkgo trees were weak in 1998, showed an immense improvement in 1999, then faltered in the 2000-growing season. The Echinacea plants did not appear to be damaged from the harsh winter climate as they flourished early in the spring of 1999 and 2000. There was both insect and disease damage noted in the Echinacea during the growing seasons but the remaining plants appeared healthy going into dormancy.
An informational session and several on-site field trips took place in 1999 and 2000 at the Plantation.

Background and Objectives:

One of the major objectives of this project is to demonstrate organically produced non-traditional crops to diversify the Northern Saskatchewan farming options in the forest region. In order to demonstrate this objective, this project has concentrated on growing three test crops: Echinacea, Raspberries and Ginkgo. The crops have been planted in a common geographical area and each is being monitored to determine survival rates and the plant reactions to different growing techniques.

Project Activities:

The three test crops were established in 1998 and the plants are monitored to keep track of survival rates under different growing conditions.

The overall survival rates in 1999 for the three test crops at the end of the growing season were:

- 66% Ginkgo Trees
- 100+% Raspberries
- 77% Echinacea Seedlings
- 15% Direct Seeded Echinacea

Canada Saskatchewan

In 2000, the overall survival rates for the three test crops at the end of the growing season were:

- 12% Ginkgo Trees
- 100+% Raspberries
- 63% Echinacea Seedlings
- 31% Direct Seeded Echinacea

Ginkgo Trees: There were fifty ginkgo trees planted during spring 1998. Thirty-seven plants (or 74%) survived through the first growing season. The Ginkgo trees were weakly during the whole 1998-growing season. Nineteen Ginkgo trees were covered to provide protection against the winters elements and all survived the dormancy period. During the same period, eighteen Ginkgo trees were not covered and fourteen survived. It was demonstrated that these plants do better when covered during dormancy.

Thirty-three Ginkgo trees (or 66%) survived the second growing season of 1999. The plants grew an average of 12" and there were no diseases or insects damage noted. All of the remaining trees were covered for winter protection.

Twenty Ginkgo trees (or 40%) survived the winter but the plants were weak and were really slow to show signs of life in the spring of 2000. There was no disease or insect damage that was noted during the growing season but unfortunately, the trees were dying off regularly. There were only six Ginkgo trees (or 12%) that were surviving at the end of the 2000-growing season. All were covered for winter protection.

Raspberries: There were a total of 240 raspberry canes transplanted during the spring of '98.

- Boyne (east end of row) 120 planted
- Souris (west end of row) 120 planted

Overall, there was a 95% survival rate from establishment to the end of first growing season. Winter dormancy did not appear to damage this crop at all even with them not being protected.

The Raspberries flourished and have multiplied into many new healthy plants during the 1999 and 2000 growing years. Survival rate is now well over 100%.

Both varieties of raspberry canes have grown tremendously over the duration of this project. They were approximately 8" high when transplanted in 1998, 5' high at the end of 1999 and, about 7' in height at the end of 2000.

Both raspberry varieties produced fruit during the project but the following differences noted:

	1999		2000	
Variety	*Yield (pounds)*	*Maturity*	*Yield (pounds)*	*Maturity*
Souris	4	Middle of Sept	10	End of Sept
Boyne	10	End of Aug	22	Middle of Sept

Echinacea:

All work completed was done organically by hand with no mechanical intervention on the test plots.

There were many differences noted between direct seeded Echinacea in Autumn 1997 and transplant seedlings in the Spring of 1998. The results are as follows:

Direct Seeded - Autumn '97	**Plants Seeded - Spring '98**
CROP DEVELOPMENT DATA	**CROP DEVELOPMENT DATA**
5,760 Seeds Planted - Oct '97	14,194 Planted - June '98
108 Surviving - Sept '98	12,756 Surviving - Sept '98
872 Surviving - Sept '99	10,982 Surviving - Sept '99
1,785 Surviving – Sept '00	8,964 Surviving – Sept '00
TIME INVESTMENT (in Hours)	**TIME INVESTMENT (in Hours)**
1997	
18 H to Plant	
1998	
42 H to Weed	110 H Germinate/Seedling Care
15 H to Water	151 H to Plant
	31 H to Weed
	15 H to Water
1999	
143 H to Weed / Disease Control	277 H to Weed / Disease Control
6 H to Pick Seed Cones	15 H to Pick Seed Cones
2000	
151 H to Weed / Disease Control	285 H to Weed / Disease Control
15 H to Pick Seed Cones	29 H to Pick Seed Cones

Results and Conclusions:

Echinacea:

Analysis - Direct Seeded Autumn '97:

*2% survived first growing season '98

*15% survived second season '99

*31% survived third season '00

Analysis - Plants Seeded Spring '98:

*90% survived first growing season '98

*77% survived second growing season '99

*63% survived third growing season '00

Survival rates for Echinacea plants seeded in spring are over twice as high than for autumn direct seeded crops. The direct seeded crop has produced new plants in the second and third growing season therefore the plants in the same test plot are at different levels of maturity. Direct seeding is a more unpredictable type of seeding regime to follow.

Diseases such as root rot and aster yellows caused by Leafhoppers occurred in both the test plots. These infestations were only slight and did not cause serious damage in either plot.

Echinacea tends to thrive in relatively dry conditions (see appendix 1 – Weather data). The Echinacea plants have a stressed look (leaves shrivel and growth is slowed) when plants are subjected to prolonged periods of cool, damp weather. This was the case during the summer of 2000.

There was a total of 50 5-gallon pails of seed cones harvested during this project. The comparisons are as follows:

Direct Seeded – Autumn '97	Plants Seeded – Spring '98
2 5-gallon pails or 1.0 lb. Seed – 1999	17 5-gallon pails or 8.5 lbs. seed -1999
7 5-gallon pails or 3.5 lbs. Seed – 2000	24 5-gallon pails or 12.0 lbs. seed -2000

Note: 1 5-gallon pail of seed cones is approximately one-half lb. of cleaned seed.

The direct seeded – Autumn'97 plants produced more flowers per plant (average of 6) than the seedlings that were planted in – Spring'98 (average of 5). This was based on a testing of 100 plants in each test plot.

In conclusion, it was found that seedlings have a higher survival rate that direct seeded Echinacea and it produces a more uniform crop as far as maturity is concerned. Considering the labor intensity of this type of organic crop, this would not be a crop that could realistically be grown in large-scale operations.

Echinacea grown organically would not be capable of having a big impact on diversification of large tracts of traditional farmland as the huge inputs in terms of time and financial resources is high. It takes a full four-year term before any income from this crop can reasonable is realized.

Ginkgo Trees:

Ginkgo trees have had a poor survival rate during this project. In conclusion, Ginkgo is not a species of tree that does well in Northern Saskatchewan.

Raspberries:

Raspberries do well with the growing conditions present in Northern Saskatchewan and they require minimal care. The Boyne variety matures sooner than the Souris variety and therefore produces more fruit. Boyne would be the recommended variety to produce in this geographical location.

Indications for Further Development:

A market for these herbs has been difficult to locate as many buyers want larger quantities than this project was able to produce. A possible further development that will be considered is to try and form a buying cooperative to provide smaller scale producers with a place to market their crops.

A 'Best Practices Guide' for growing Echinacea is attached. This guide contains the best practices in each stage of producing Echinacea based on the findings from this project.

Information on Information Sharing:

Many information-sharing sessions were held over the course of this project as well as several discussions with other producers. Many individuals have expressed an interest or curiosity in organically produced herbs. The large time commitment appeared to be the biggest barrier for producers in considering Echinacea as a cropping option.

Project Success and Relationship with the Objectives:

There were three organically produced non-traditional crops grown during this project, Ginkgo Trees, Echinacea and Raspberries. The non-traditional crops outlined here have changed the current landscape on a parcel of regular farming land. Economically this crop has not been a success so far as a market has not been found to sell the products produced. This project has been successful in providing summer employment opportunities for several students as their services were used in each stage of the growing cycle.

Appendix 1 - ***WEATHER DATA***

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
1998 Ave High	-15.6	-2.6	-1.0	14.6	22.0	21.5	24.4	25.9	18.5	9.5	-2.9	-10.1	104.2
1998 Ave Low	-27.3	-13.2	-16.0	-2.3	2.8	7.2	10.4	9.1	3.0	-1.7	-11.6	-21.9	-61.5
1998 Total Precipitation	27.8	6.2	1.2	11.8	10.2	96.4	93.0	32.3	36.6	47.4	21.4	20.4	404.7
1999 Ave High	-12.7	-6.1	1.0	11.0	15.1	20.9	21.5	23.8	17.1	9.8	1.9	-3.3	100.0
1999 Ave Low	-23.5	-19.8	-11.5	-2.0	3.3	5.9	8.8	8.1	1.3	-3.1	-8.7	-15.7	-56.9
1999 Total Precipitation	25.6	17.0	7.0	37.4	53.2	41.0	84.8	84.2	24.2	9.8	17.6	26.4	428.2
2000 Ave High	-11.9	-8.1	-2.1	8.2	16.9	21.2	22.4	21.6	16.1	9.9	-0.9	-7.1	86.2
2000 Ave Low	-24.0	-19.7	-14.7	-3.1	3.6	7.9	9.1	9.0	3.5	-1.4	-10.3	-21.9	-62.0
2000 Total Precipitation	18.9	12.1	16.6	19.7	42.8	73.4	79.9	60.6	37.2	15.6	16.9	12.2	405.9
Normal High	**-12.8**	**-8.4**	**-1.6**	**9.0**	**17.8**	**21.9**	**23.7**	**22.7**	**16.2**	**10.3**	**-2.7**	**-10.9**	**85.2**
Normal Low	**-24.2**	**-20.9**	**-14.6**	**-3.2**	**3.5**	**8.2**	**10.6**	**9.1**	**3.6**	**-1.3**	**-11.8**	**-21.4**	**-62.4**
Normal Precipitation	**18.3**	**13.2**	**18.5**	**17.5**	**38.4**	**69.6**	**75.7**	**57.7**	**38.3**	**15.8**	**20.2**	**21.6**	**404.8**

Differences

1998 vs Normal High	-2.8	5.8	0.6	5.6	4.2	-0.4	0.7	3.2	2.3	-0.8	-0.2	0.8	19.0
1998 vs Normal Low	-3.1	7.7	-1.4	0.9	-0.7	-1.0	-0.2	0.0	-0.6	-0.4	0.2	-0.5	0.9
1998 vs Normal Prec	9.5	-7.0	-17.3	-5.7	-28.2	26.8	17.3	-25.4	-1.7	31.6	1.2	-1.2	-0.1

1998
Above Normal Temp
Below Normal Prec

1999 vs Normal High	0.1	2.3	2.6	2.0	-2.7	-1.0	-2.2	1.1	0.9	-0.5	4.6	7.6	14.8
1999 vs Normal Low	0.7	1.1	3.1	1.2	-0.2	-2.3	-1.8	-1.0	-2.3	-1.8	3.1	5.7	5.5
1999 vs Normal Prec	7.3	3.8	-11.5	19.9	14.8	-28.6	9.1	26.5	-14.1	-6.0	-2.6	4.8	23.4

1999
Above Normal Temp
Above Normal Prec

2000 vs Normal High	0.9	0.3	-0.5	-0.8	-0.9	-0.7	-1.3	-1.1	-0.1	-0.4	1.8	3.8	1.0
2000 vs Normal Low	0.2	1.2	-0.1	0.1	0.1	-0.3	-1.5	-0.1	-0.1	-0.1	1.5	-0.5	0.4
2000 vs Normal Prec	0.6	-1.1	-1.9	2.2	4.4	3.8	4.2	2.9	-1.1	-0.2	-3.3	-9.4	1.1

2000
Above Normal Temp
Above Normal Prec

ETL Enviro-Test

A DIVISION OF *ETL CHEMSPEC ANALYTICAL LIMITED*

9936 - 67 Avenue, Edmonton, AB T6E 0P5 Telephone: (403) 413-5227 Fax: (403) 437-2311
Bay 2, 1313 - 44 Avenue N.E., Calgary, AB T2E 6L5 Telephone: (403) 291-9897 Fax: (403) 291-0298
General Purpose Building, 124 Veterinary Road, Saskatoon, SK S7N 5E3 Telephone: (306) 668-8370 Fax: (306) 668-8383
Bay 3, 10919 - 96 Avenue, Grande Prairie, AB T8V 3J4 Telephone: (403) 539-5196 Fax: (403) 539-6295
Unit F - 1420 Clarence Avenue, Winnipeg, MB R3T 1T6 Telephone: (204) 452-8104 Fax: (204) 477-8719

Dear Joanne:

Unfortunately, we have been unable to develop recommendations for Echinacea because we have been unable to find any research done for that crop in the Canadian prairie provinces. We certainly are not adverse to providing recommendations for new crops, but it is difficult to give an accurate recommendation when the research hasn't been done yet for the prairies. If you have any questions or comments, please feel free to call me anytime at 1-800-667-7645.

Sincerely,

Tom Staples, B. S. A., A. Ag.
Agronomist, ETL Laboratories

SOIL TEST REPORT

Enviro-Test Agricultural Services
124 Veterinary Rd.
Saskatoon, SK S7N 5E3
(306) 668-8370 FAX (306) 668-8383
In Canada toll-free 1-800-667-7645

SAMPLE I.D. NUMBER
641901

SAMPLE INFORMATION IS: 4218 685/ 8

Date received 16 Oct 97 | Dealer code 476
Date of discard 6 Nov 97 | Customer code
Date Report printed 18 Oct 97 | Summary faxed ■ Yes ☐ No

TO:
JOANNE DALLYN
C/O : SASK WHEAT POOL
Box 1059
Meadow Lake , SK
S0M 1V0
Ph #: 1-306-236-3616 Fax #: 1-306-236-4899

FIELD INFORMATION

Field No. N/A Acres 140 Type of test Pkg.1
Legal Location SE 28 60 17 W3 (Quarter Section Township Range Meridian)
Previous crop or practice Fallow
SOIL CLIMATIC ZONE: Moist Black

SOIL CHARACTERISTICS

(STANDARD REPORTING)						(OPTIONAL REPORTING AT REQUEST)					
			SALINITY LEVELS					PARTICLE SIZE ANALYSIS			
SAMPLE DEPTH inches	TEXTURE (Qualitative)	pH 1:2 soil:water	CONDUCTIVITY 1:2 soil:water mS/cm	Saturation Extract (calculated) mS/cm	RATING	ORGANIC MATTER %	LIME CONTENT (Qualitative)	% Sand	% Silt	% Clay	AMMONIUM-N (lb/acre)
0-12	Clay Loam	7.9	0.4	0.9	Non Saline						

SOIL TEST LEVELS (lb/acre)

NUTRIENT SUFFICIENCY LEVEL FOR GROWING SPECIFIED CROP: ■ CANOLA ☐

EXCESS
SUFFICIENT
MARGINAL
DEFICIENT

SAMPLE DEPTH (inches)	NITROGEN (NO_3-N)	PHOSPHORUS (P)	POTASSIUM (K)	SULPHUR (SO_4-S)	COPPER (Cu)	MANGANESE (Mn)	ZINC (Zn)	BORON (B)	IRON (Fe)	CHLORIDE (Cl)
0-12	89	108+	590	86+						

YIELD GOAL*COMPARISON and RECOMMENDED NUTRIENT APPLICATION RATES (lb/Ac of Actual Nutrient)

CANOLA	N	P_2O_5	K_2O	S	Cu	Mn	Zn	B	Fe	Cl
41 Bu/Ac Requires 9.5 Inches of Precip. (25 % Chance of this Precip.)	0-0	5-10	0-15	5-10						
32 Bu/Ac Requires 7.0 Inches of Precip. (50 % Chance of this Precip.)	0-0	5-10	0-15	0-10						
22 Bu/Ac Requires 4.1 Inches of Precip. (75 % Chance of this Precip.)	0-0	5-10	0-15	0-10						
No Goal/Target Submitted										

	N	P_2O_5	K_2O	S	Cu	Mn	Zn	B	Fe	Cl

SOIL AVAILABLE MOISTURE: ☐ ACTUAL: _____ inches ■ TYPICAL: 4.0 inches ☐ IRRIGATION

OTHER RECOMMENDATIONS AND COMMENTS

The rate of Phosphorus application is based on seed-placement. Broadcasting and incorporation requirement on the average is 2.5 times that of seed-placement.
There is less than a 25% chance that your crop will show a yield response to the application of this nutrient

Pro-Cert Organic Systems

Box 100A, RR#3 - 475 Valley Road / Saskatoon, SK / S7K 3J6
Phone: (306) 382-1299 Fax: (306) 382-0683

ISO 65

PRODUCER INSPECTION CHECK-LIST & REPORT
PART I

INSPECTION PARTICULARS

Producer: Jo-anne Dallyn & Anne D'Lusos Inspector: Byron JS Nemes
Date of Inspection: Sept 19, 2000 Registration No. PC 599
Time Arrived: 12:45 pm Time Departed: _____

Application Review

Is there a complete Application or Application for Extension? ✓Yes __ No
Is the description of activities on the farm accurate and complete? ✓Yes __ No
Is there organic livestock? __Yes ✓ No.
If **Yes**, complete Appendix A.
Is there processing on the farm? __Yes ✓ No.
If **Yes**, complete Appendix B.
Is there a greenhouse? __Yes __ No.
If **Yes**, complete Appendix C.
Comments: _____

Production Unit History & Conversion Plan

Is the farm 100% organic? ✓Yes __ No.
If the farm is not 100% organic is there a transition plan? __Yes __ No.
Is the transition plant followed? __Yes __ No.
Is there parallel production? __Yes __ No.
Comments: for the farm conv. unit. N/A
for crop operation

Organic Certification History

Has the applicant been previously certified? __Yes ✓ No.
Has the most recent inspection report and Organic Certificate been attached? __Yes __ No.
Have all conditions been met? __Yes __ No.
Comments: _____

Crop Rotational Plan

Is there an established rotation? __Yes ✓ No.
Is a legume plough down included? __Yes ✓ No
Comments: _____

Cropping Practices

Are cropping practices described in the Application accurate? ✓Yes __ No
Is seed from an organic source? ✓Yes __ No
Are seedlings from an organic source? ✓Yes __ No - Uncert.
Is the GMO status verifiable? ✓Yes __ No
Is there any seed treatment? __Yes ✓ No
Is there any irradiation? __Yes ✓ No

Farm Description

Is there a farm map? __Yes ✓ No.
Is there a yard map? __Yes ✓ No.
Are there field maps? __Yes ✓ No.
Does the farm map include all organic, transitional and conventional land? ✓Yes __ No.
Are all maps accurate? __Yes ✓ No.
Comments: _____
To Email yard + farm maps

Soil Management Program

Is there a soil building program? __Yes ✓ No
Does the plan include green manure? __Yes ✓ No
What is the frequency of green manure? _____.
Is animal manure used? __Yes ✓ No
How long was it composted? _____.
Are off-farm amendments used? __Yes ✓ No
Has label & MSDS been provided? __Yes ✓ No
Comments: no crops for synth use
of bone, blood meal product
none applied in last 4 yrs. Bulk product
in rechargeable

Soil Quality Monitoring

Is there a soil monitoring program? ✓Yes __ No
Is it maintained consistently? ✓Yes __ No
Has the producer provided recent copies of soil test results? ✓Yes __ No

Comments: continue soil test program
submit copies of most recent results

Produce Handling & Storage

Have all grain bins been listed? ✓Yes __ No
Are all grain bins properly numbered? __Yes __ No
Are all bins suitable for organic storage? __Yes __ No
List unsuitable bins: _____

Bin No	Capacity (bus)	Product in Storage	Current Volume (bus)	Audited (Y or N)
		most likely sold fresh - no storage		

Sanitation

Are the bins properly cleaned? ✓Yes __ No
Is equipment properly cleaned? ✓Yes __ No
Was a cleaning log reviewed? __Yes ✓No
Do all inspected equipment and facilities meet organic standards for cleanliness? ✓Yes __ No
Comments: shed & machine scratch test

Is sale of produce from last crop year verifiable by documentation? __Yes ✓No
Comments: most likely no harvest this year

Irrigation System

Is the water potable? __Yes ✓No
Type of system? irrig. fm lake
Have water tests been conducted? ✓Yes __ No
Are results available to Pro-Cert? ✓Yes __ No
Notes: suggest water quality analysis - lake threatened by run-off

Producer Records (Chain of Custody)

Has audit trail been submitted for previous crop year? __Yes ✓No
Is audit trail for this crop year current to the time of inspection? __Yes __ No

Sample Log

List any samples taken during the inspection.

Notes

Bone + Blood meal used in 97+98 greenhouse plugs.

- Send copy of application

Organic Compliance Issues

- Submit Form 1 your trip
- Submit latest soil test results
- Do not use bone + blood meal
- Start a mulch switch log
- Suggest water quality analysis

Inspector & Applicant Attestation

I do hereby verify that the above information, to be used for evaluation of the applicant for organic certification, is accurate and true to the best of my knowledge.

Inspector's Signature: _____ **Date:** Sept 19, 2000

Applicant's Signature: Jo-Anne Reilly **Date:** Sept 19, 2000

Best Practises Guide – Echinacea E. Angustifolia

Species

E. Angustifolia or the narrow-leafed purple coneflower is the only Echinacea species that occurs naturally in Saskatchewan.

Seed Source

Important to use seed of high quality and purity, which means seed of verified true species and high viability. Seed should be clean. Seed should be stored in cool dry storage. Seed should only be purchased from a supplier with excellent reputation for quality and integrity.

Seed Stratification

Seeds germinate more readily when they are stored in the freezer for at least 60 days. This process is required to break the dormancy of seeds. About two weeks before germinating place seeds in the fridge. Then remove from the fridge and begin the germination process.

Seed Germination

To assist with disease control, soak the seed in a solution of 1 part bleach to 100 parts of water for 5 minutes then again with sterile water for 10 minutes. This is to help prevent the alternaria leaf spot disease. Soak for 5-6 hours in sterilized warm water. Place seed on wet paper towels on trays. Distribute pieces of cut-up apple amongst the seed and cover entire tray with plastic wrap. Place in well-lit place or under grow lights in a cool area. Seed will become soft and get little white tails in about 2-3 days. Plant seeds with the tail end down – just push into prepared soil and do not cover with dirt, as they need the light to grow. Plant into plug trays of moist sterilized soil containing 1/3 peat moss, 1/3 sand and, 1/3 potting soil. Plug trays with a depth of 6" worked well for this stage as the roots did not have to be disturbed until the plants were ready to go to the field.

Greenhouse Planting

These seedlings are very hardy and are not affected negatively by cool weather. Optimum temperature in the greenhouse was determined to be under 16c during the day and 12c at night. If it is too hot in the greenhouse, the seedlings will wilt and the potting medium will dry out readily. If there is too much humidity in the greenhouse the a whitish looking mould covers the surface of the growing medium and stunts the plants growth.

Field Planting

Seedlings are ready to plant when the roots start coming through the bottom of the planting trays. The upper portion of the plant will be in the four to six leaf stage. By leaving the plants to grow to this size, there appears to be less set back once the plants are placed in the field. Echinacea like sandy loam soil the best but will tolerate many soil types as long as is has good drainage. We had the best luck with Echinacea when we planted into raised beds. The beds were raised approximately one foot higher than ground level and were approximately six-feet across the top. We covered the rows with water-permeable ground cover for effective weed control especially in the first year of growth. Angustofolia plants like to touch each other and we found that the idea plant spacing is around the 6-inch mark. These plants have a taproot and a fairly small bushy top.

Raised bed

It was established that there was a higher survival rate for plants that were grown in raised beds versus ground level planting. This was summed up to be caused by a difference with drainage. These plants do not do well when they sit in water, even for a short time. It has been said that they do not like 'wet feet'.

Growing Conditions

Angustofilia can handle long dry spells well and does not succumb to heat stress readily. Wet or damp conditions on the other hand are very detrimental to the development of this crop.

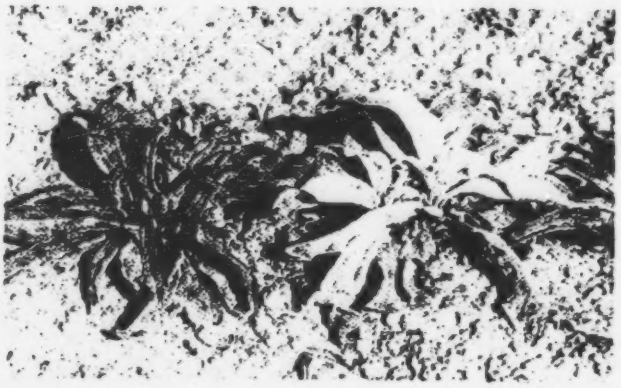
Fertilizers

There are very few organically approved fertilizers available for use on this crop. The two most effective ones are fish fertilizer and wood ashes. When using wood ashes, it is imperative that the wood used in the process has not been exposed to any type of chemical operation. It is best to verify with the organic certification body as to which fertilizers may be used as the list changes from time to time.

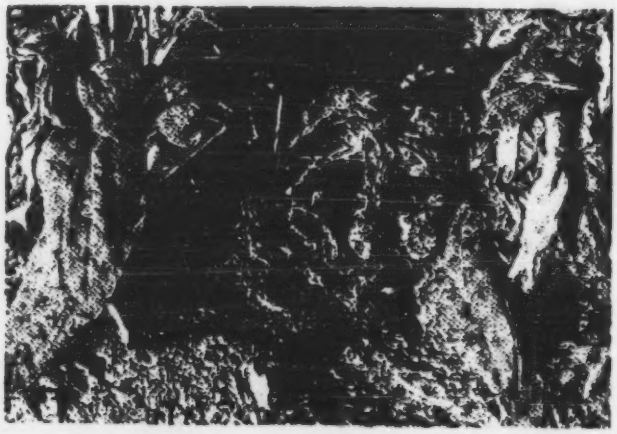
Diseases

There are six major diseases of Echinacea plants but no approved organic pesticides or fungicides registered in Canada for this crop. It is highly recommended that producers become familiar with each of the diseases that include:

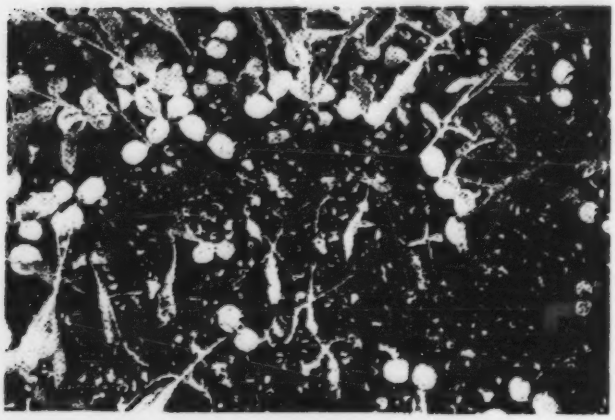
Aster yellows: is an infection that causes bright yellowing of leaves that eventually kills the plant. This disease is primarily spread by leafhoppers. It is best to pull out and destroy plants that show typical symptoms of this infection so other plants do not become infected.



Sclerotinia stem
And root rot: is a fungus that can infect stems and leaves, it forms dark brown to black lesions at and above the soil level. Eventually the whole plant turns brown, dry and brittle. Roots become rotted and black. This fungus is more prevalent under moist or wet conditions. The diseased plants are easily pulled from the soil. This disease seems to spread when one diseased plant comes in contact with a healthy plant. It is best to pull out and destroy infected plants.

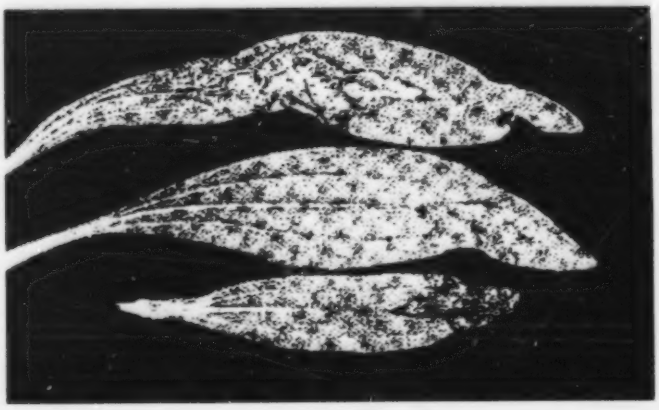


Damping-off: this disease occurs with seedlings and is caused by various fungi. Possible causes include contaminated growing media and over watering. Significant losses can occur under cool, damp conditions during the seed germination and green house planting stages of the operation. Diseased plants first show blackening of the root tips, followed by browning of the root and stem, shrinking and twisting of young leaves. Finally seedlings wilt, collapse and die. To prevent the spread of this disease, use sterilized growing median and do not over water seedlings.



Fusarium root and crown rot: is a commonly found fungus in infected crowns and roots. This disease occurs when the plant is damaged in some way. The fungi invade the wounded tissue especially under damp growing conditions. The roots of these plants grow many fibers instead of forming a tap root system like they should. To avoid this disease try not to injure roots and do not over water plants.

Botrytis blight: this disease is also caused by a fungus and infects the leaves and stems of the plant but it does not usually kill the plant. This fungi spreads quickly under wet conditions. The first stage of this disease is brown water-soaked lesions on leaves that can spread quickly to the stem of the plant. This fungus can cause several leaves or the whole flower stem to brown and die off. A moldy gray appearance is left on dead or dying parts of the plant. It is recommended to remove infected plant debris and not to over-water.



Alternaria leaf spot: this disease infects leaves causing small dark brown to black colored spots, which can grow together and form large lesions under wet conditions. Sometimes the center of the spot falls out leaving holes in the leaves of the plant. To help prevent this disease, sterilize seeds with a bleach solution (see seed germination section). Do not over water, especially when seedlings.

Harvesting Herb & Seed

To harvest seed, clip the flower portion of fully mature plants. It was found that the larger the flower, the more mature and viable the seed is. The seed is located under the center part of the flower and threshing either by hand or machine is required to extract the seed. Harvesting flowers can occur anytime after the plant has finished the flowering stage.

To harvest herb, cut plants down to about 6" (or about 2/3 of the plant) every fall before it freezes. Once it freezes, the medicine that is stored throughout the plant during the growing season goes down to the roots and there is no medicinal properties left in the leaves.

Before it freezes, the leaves, flowers and stems can be dried and used. We were not successful in finding a market as the buyers we contacted wanted huge quantities of Echinacea herb.

Harvesting Root

The root can be harvested in the third or fourth year. Many different methods have been used to harvest the root. The roots of mature plants are up to two feet in the ground so whatever is used must be able to reach this depth. The root of mature plant is mostly a taproot but they have a number of side roots that grow out from the main root. These roots are smaller and easily damaged when handling the fresh plant.

Post-Harvest Handling

The roots can be sold fresh or in a dried state. Either way, the roots have to be washed thoroughly. If air-dried, place roots sparingly on either plastic or wooden racks. Air must be circulated over the root in temperatures below 40c. Exposure to sunlight should be avoided with the harvested roots as it could negatively affect active ingredients. Roots should not touch each other as mould can occur quickly. Roots must be spread out in a thin layer and moved around every day for two weeks or until optimum moisture content is achieved (usually 8-10%) on a wood moisture tester. Each mature dried root weighs approximately 4 oz therefore it takes 4-5 plants per dried pound.

Quality Testing

Organic certification
Authenticity test
Other testing as determined by the buyers

If the Echinacea is of good quality, it should pass the 'tingle test' – when you put a small piece of the plant on your tongue, your mouth should begin to tingle and numb in a minute or two.

Markets

Markets are difficult to find for this herb as many of the buyers want to buy in very large quantities. With the labor factor included, it is difficult for a single producer to grow in large amounts. It would be very beneficial if the producers formed some sort of a buyer group were many producers could sell through the cooperative to the larger buyers. Prices for this herb have dropped dramatically over the last few years as many more producers have gotten into producing this herb.

Acknowledgment

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References:

Alsager, J. and Keep, R, 1997. Echinacea Angustifolia - Cariboo Ginseng.

Barl, B, 1997. Proceedings of Cropportunities IV Conference, July 21-22, 1997, University of Saskatoon SK Canada.

Barl, B, 1999. General Echinacea information - University of Saskatoon, Saskatchewan.

Chang, K-A., Hwang, S-F., Howard, R. and Blade, S. 1999, Agri-fax of Alberta Agriculture, Food and Rural Development.